

Appl. No. 10/783,495
Amdt. Dated 08/25/2009
Suppl. Resp. to 05/01/2009 Off'l action

Attorney Docket No.: N1085-00251
[TSMC2004-0834]

Claims:

The listing of pending claims in the application that replaces all previous versions, is as follows:

- 1 1. (Currently Amended) A method for controlling exposure energy on a
2 patterned wafer substrate, comprising the steps of:
3 controlling the exposure energy with a feedback process control signal of critical
4 dimension,
5 and further controlling the exposure energy with a feed forward process control
6 signal of a compensation amount that compensates for thickness variations in a
7 subjacent layer beneath a top layer, by combining the feed forward process control
8 signal with the feedback process control signal to control the exposure energy used in
9 patterning the top layer,
10 the critical dimension being one of a width, a spacing and an opening of the
11 patterned wafer substrate and the top layer being a non-photoresist layer.
- 1 2. (Cancelled)
- 1 3. (Original) The method of claim 1, further comprising the step of: supplying the
2 feed forward process control signal by a feed forward controller.
- 1 4. (Previously Presented) The method of claim 1, wherein the subjacent layer
2 comprises an interlayer.
- 1 5. (Previously Presented) The method of claim 4, wherein the step of controlling the
2 exposure energy by a feed forward process control signal utilizes a signal of
3 measurement of thickness remaining of the interlayer after chemical mechanical
4 planarization thereof.

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- 1 6. (Original) The method of claim 1, further comprising the step of: calculating the
2 compensation amount according to a polynomial function with a coefficient of the
3 function being based on a measurement of a remaining thickness of a planarized
4 interlayer.
- 1 7. (Previously Presented) The method of claim 1, further comprising the step of:
2 calculating the feedback process control signal of critical dimension measurement of a
3 top layer in a previous manufacturing lot.
- 1 8. (Previously Presented) The method of claim 1, further comprising the steps of:
2 calculating the compensation amount according to a polynomial function with a
3 coefficient of the function being based on a measurement of a remaining thickness of
4 the subjacent layer; and calculating the feedback process control signal of critical
5 dimension measurement of a top layer in a previous manufacturing lot, the subjacent
6 layer being a planarized interlayer.
- 1 9. (Previously Presented) The method of claim 1, further comprising the step of:
2 calculating the compensation amount according to a polynomial function with higher
3 order coefficients set at zero.
- 1 10. (Previously Presented) The method of claim 1, further comprising the step of:
2 calculating the compensation amount according to a linear function.
- 1 11. (Previously Presented) The method of claim 1, further comprising the step of:
2 calculating the compensation amount according to a segmented linear function.
- 1 12. (Currently Amended) A system for controlling exposure energy on a first
2 patterned wafer substrate, comprising:

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3 a feed forward controller providing a feed forward control signal to an exposure
4 apparatus based on a thickness measurement of an interlayer of the first patterned
5 wafer substrate for controlling the exposure energy focused on a top layer of the first
6 patterned wafer substrate, and

7 a feedback controller providing a feedback exposure energy control signal to the
8 exposure apparatus based on critical dimension measurement of a top layer of a
9 second patterned wafer substrate of a previous manufacturing lot, the critical dimension
10 being one of a width, a spacing and an opening of the second patterned wafer
11 substrate,

12 wherein a combiner combines the feed forward control signal and the feedback
13 exposure energy control signal to produce a combined signal that is provided to the
14 exposure apparatus, the top layer being a non-photoresist layer.

1 13. (Original) The system of claim 12, further comprising: a thickness measurement
2 device providing thickness measurement data to the feed forward controller.

1 14. (Previously Presented) The system of claim 12, further comprising: a critical
2 dimension measurement device providing critical dimension measurement data to the
3 feedback controller.

1 15. (Previously Presented) The system of claim 12, further comprising:
2 a thickness measurement device providing thickness measurement data to the
3 feed forward controller and
4 a critical dimension measurement device providing critical dimension
5 measurement data to the feedback controller.

1 16. (Previously Presented) The system of claim 12, further comprising: a thickness
2 measurement device providing thickness measurement data of a shallow trench
3 isolation layer of the first patterned wafer substrate to the feed forward controller.

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1 17. (Previously Presented) The system of claim 12, further comprising: a critical
2 dimension measurement device providing critical dimension measurement data of a
3 poly-gate of wafer substrate of a previous manufacturing lot.

1 18. (Previously Presented) The system of claim 12, further comprising:
2 a thickness measurement device providing thickness measurement data of a
3 shallow trench isolation layer of the first patterned wafer substrate to the feed forward
4 controller, and
5 a critical dimension measurement device providing critical dimension
6 measurement data of a poly-gate of a previous manufacturing lot.

1 19. (Previously Presented) The system of claim 18 wherein,
2 the feed forward controller is user configurable by having one or more polynomial
3 coefficients set to zero in a polynomial function model.

1 20. (Original) The system of claim 12 wherein;
2 the feed forward controller is user configurable by having one or more polynomial
3 coefficients set to zero in a polynomial function model.

1 21. (Previously Presented) The system of claim 20, further comprising: a thickness
2 measurement device providing thickness measurement data of a shallow trench
3 isolation layer of the first patterned wafer substrate to the feed forward controller.

1 22. (Previously Presented) The system of claim 20, further comprising: a critical
2 dimension measurement device providing critical dimension measurement data of a
3 poly-gate of the second patterned wafer substrates of a previous manufacturing lot.